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ABSTRACT

This information booklet is intended to serve as a companion document to the course syllabus for technology education in New York. It will assist teachers in developing lesson plans that address performance objectives, supporting competencies, and subsequent testing. It first provides important information to teachers, guidance counselors, and administrators regarding the purpose, development, and administration and scoring of the statewide proficiency examination in technology education. Students entering grade 9 who pursue approved sequences in occupational education must take and pass proficiency examinations in order to earn a Regents or local diploma. A blueprint and examination format illustrate the percentage of questions on the examination from topics in each of the three systems courses: communications, production, and transportation. A representative sample of questions selected from modules and topics within each technology education systems course is provided. The curriculum guide portion corresponds to the syllabi for the three courses--communications systems, production systems, and transportation systems. For the communications systems course, a list of questions or examples is provided which directly correspond to the supporting competencies of each performance objective. These are intended to help the teacher clarify and understand the main focus of the performance objectives. For the other two courses, a list is provided of that content that the student must know for each of the performance objectives. Amount of time to be spent on each objective is suggested. (YLB)

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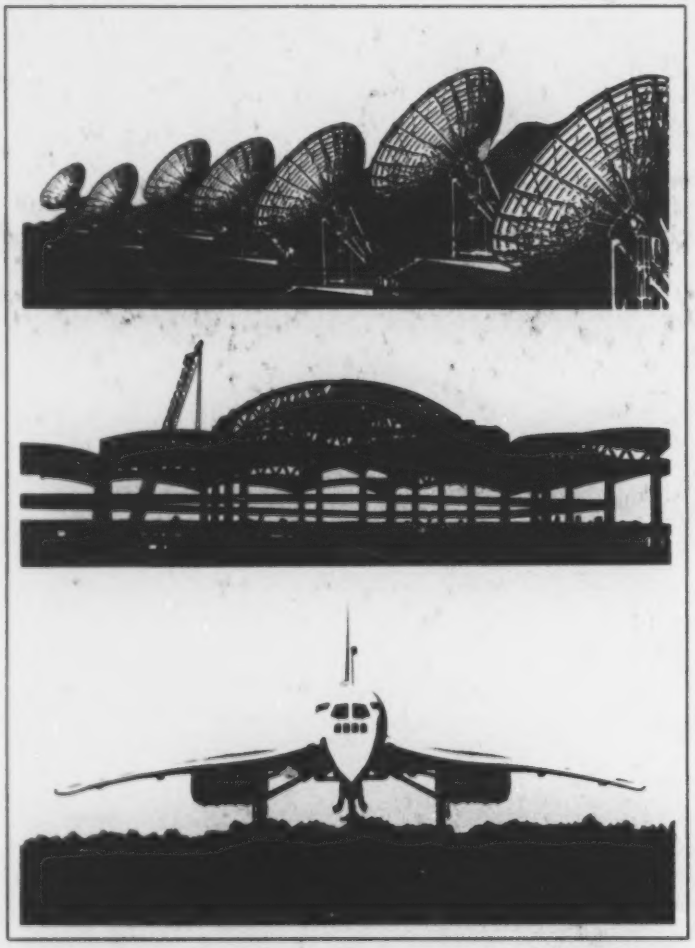
A TESTING PERSPECTIVE ON THE CURRICULUM

TECHNOLOGY EDUCATION SYSTEMS:

COMMUNICATION ■
PRODUCTION ■
TRANSPORTATION ■



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The University of the State of New York
The State Education Department
Division of Occupational Education Programs
Albany, New York 12234

CE 057 161

A Teacher's Guide for Proficiency Examinations
In
Technology Education

Communications Systems
Production Systems
Transportation Systems

A Testing Perspective on the Curriculum

Fall 1987

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Office of Occupational and Continuing Education
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The Education Department and the Technology Education Profession are indebted to those listed above for their time, talent, and expertise.

A TESTING PERSPECTIVE ON THE TECHNOLOGY EDUCATION CURRICULUM

This information booklet is intended to serve as a companion document to the course syllabus. It will assist teachers in developing lesson plans that address performance objectives, supporting competencies, and subsequent testing. Given the time constraints in the instructional plan, key points listed with each competency suggest what general questions be answered, and indicate potential test items.

It is suggested that the following points be considered as lesson plans are parepared:

Concepts to be taught
Performance Objectives
Supporting Competencies
Time Constraints

Teachers need to read the syllabus in detail. Familiarity with the syllabus combined with the following testing perspectives, will result in an efficient use of time.

Performance Objectives and Supporting Competencies – Instructional Strategies

Performance objectives and supporting competencies are established to provide goals, indicate the content and depth of instruction, identify time blocks, serve as criteria for selecting instructional strategies and learning experiences, and set evaluative measures. Performance objectives and supporting competencies are established to do the following:

- provide goals;
- indicate the content and depth of instruction;
- identify time blocks;
- serve as criteria for selecting instructional strategies and learning experiences;
- set evaluative measures.

Performance objectives and supporting competencies are listed separately for each topic and should be referred to when planning instructional strategies and conducting evaluations.

The proficiency examination may contain questions on any performance objective, but no single examination will contain questions on every performance objective. Therefore, instructional strategies should be planned so that students can reach all of the performance objective and supporting competencies.

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ASSISTANT COMMISSIONER FOR OCCUPATIONAL AND CONTINUING EDUCATION
DIRECTOR, DIVISION OF OCCUPATIONAL EDUCATION PROGRAMS

December 1987

TO: Principals of Public and Nonpublic Schools
Directors of Occupational Education
Directors of Guidance, Public and Nonpublic Schools
Technology Education Department Chairperson, Public and Nonpublic Schools
Technology Education Teachers, Public and Nonpublic Schools

FROM: John M. Fabozzi, Chief
Bureau of Career Awareness & Practical Arts Programs

SUBJECT: Occupational Education Proficiency Examination in Technology Education, A Testing Perspective on the Curriculum

This publication, *A Teacher's Guide for Proficiency Examinations in Technology Education — Communications Systems, Production Systems, Transportation Systems,* was developed to provide important information to teachers, guidance counselors, and administrators regarding the purpose, development and administration of the statewide proficiency examination in Technology Education.

The curriculum guide portion of this publication provides teachers with information which adds a dimension beyond the performance objectives and supporting competencies for the three Technology Education Systems Courses. This information, used in conjunction with the three syllabi for these courses, can help ensure that all performance objectives have been addressed and that students attain a level of skill achievement needed to successfully pass the proficiency examination.

If you have questions on this publication, or on the Occupational Education Proficiency Examination in Technology Education, please contact:

William J. Boudreau
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Division of Occupational Education Programs
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Foreword

This publication is intended to provide teachers with information that adds a dimension beyond the performance objectives and supporting competencies for the Technology Education Systems courses. This information will help teachers ensure that they have identified and taught all pertinent concepts and principles which will help students to successfully attain the standards set forth in the syllabi. In addition, the publication provides administrators, counselors, and teachers with information concerning the use, administration, and development of the Occupational Education Proficiency Examination in the Systems Courses. Questions concerning the information in this publication should be directed to the Bureau of Career Awareness and Practical Arts Programs, One Commerce Plaza, Room 1619, Albany, NY 12234 (518) 474-3954.

Purpose of the Examination

The examinations in the Systems Courses are proficiency examinations designed to measure a student's knowledge and understanding of the performance objectives and supporting competencies in the State syllabi. Passing the examination satisfies part of the requirement for completing a sequence in Technology Education for a high school diploma. Use of a student's score in determining the student's final grade in the Systems Courses is the prerogative of the local educational agency.

Required Use of the Examination

Students first entering grade 9 in 1988 and thereafter who pursue approved sequences in occupational education must take and pass proficiency examinations where available in order to earn a Regents or local diploma. The requirement for Technology Education is, one examination, taken in two parts. Each part will contain 50 one point questions and will be taken immediately after students complete each half unit course. A total of 65 correct answers will be required to pass the examination. A student who fails the examination is not required to take any specific remediation and may retake the examination whenever it is offered by the Education Department.

In addition, in accordance with Section 100.5(d) (1) of the Commissioner's Regulations, students may earn units of credit without completing units of study. Those students who achieve a score of at least 85% on the State-developed proficiency examination in any of the Systems Courses and meet the other criteria as outlined in the regulation may earn a total of ½ unit of credit for each course.

Administration and Scoring

The first required administration of the Technology Education Proficiency Examination is scheduled for January 1989 at a date and time to be specified by the State Education Department. Thereafter, it will be offered a minimum of two times a year, in January and June. Consideration will be given to an August test date beginning in 1990 based upon the need of local educational agencies.

The Department will provide *experimental examinations* in Technology Education, available for use by all interested schools in January 1988. The format of these examinations will parallel that of the examinations which will be offered beginning in January 1989. In addition, a representative sample of schools will be asked to administer these experimental examinations in January 1988 and return the answer sheets to the Education Department for statistical analyses.

Scoring the students' answer sheets is the responsibility of the local educational agency. The separate answer sheets provided by the Education Department may be either hand scored or machine scored on NCS equipment. (The Department will provide scoring overlays for hand scoring the answer sheets.)

The results of the required examinations beginning in January 1989 will be included on the Comprehensive Assessment Report (CAR), and the answer papers will be subject to review by the Education Department.

Alternative Testing Techniques for Students with Handicapping Conditions

A student who has been identified by the Committeee on Special Education as having a handicapping condition may be eligible to use alternative testing techniques. Eligibility is determined on an individual basis. The consistent use of alternative testing techniques is important for providing a student with a handicapping condition the opportunity to demonstrate his or her knowledge and skills without being limited by a handicapping condition. The intent of alternative testing techniques is to provide a means by which a student with a handicapping condition can participate on an equal basis with nonhandicapped peers.

A student with a handicapping condition taking a proficiency examination in occupational education must be provided with the alternative testing techniques specified on the student's Phase I Individualized Education Program (IEP). The alternative testing techniques available for this testing would be similar to those approved for the Regents competency tests. Further information is contained in the manual entitled *Alternative Testing Techniques for Students with Handicapping Conditions*. Copies are available form the Office of Education of Children with Handicapping Conditions.

Examination Development Process

Questions developed for the proficiency examinations in Technology Education were written by Technology Education teachers according to a blueprint prepared by a committee of Technology Education teachers and administrators. These questions were submitted to the State Education Department for initial content and technical review, then pretested on a representative sample of technology education students throughout the State. The pretests were returned to the Education Department where each question underwent statistical analysis and further review. The examinations were prepared from the bank of pretested questions by a committee composed of teachers from Technology Education.

Blueprint and Examination Format

The experimental proficiency examinations in Technology Education consist of 50 multiple-choice questions in each of the three Systems Courses. These questions were selected based on the following blueprints:

Course – Communication Systems

Module – Audio – Audio/Visual

Topic	Percentage of Questions on Examination
Inputs	6-8
Resources	2-4
Processes	29-31
Outputs	6-8
Feedback/Control	2-4

Module – Graphics

Topic	Percentage of Questions on Examination
Inputs	6-8
Resources	2-4
Processes	29-31
Outputs	6-8
Feedback/Control	2-4

Course – Production Systems

Module – Manufacturing

Topic	Percentage of Questions on Examination
Inputs	1-3
Resources	14-16
Processes	24-36
Outputs	1-3
Control	5-7

Module – Construction

Topic	Percentage of Questions on Examination
Inputs	1-3
Resources	14-16
Processes	24-26
Outputs	1-3
Control	5-7

Course – Transportation Systems

Module – Land

Topic	Percentage of Questions on Examination
Inputs	3-5
Resources	18-20
Processes	18-20
Outputs	4-6
Control	1-3

Module – Marine

Topic	Percentage of Questions on Examination
Inputs	1-3
Resources	7-9
Processes	7-9
Outputs	4-6
Control	1-3

Module – Aerospace

Topic	Percentage of Questions on Examination
Inputs	1-3
Resources	7-9
Processes	8-10
Outputs	3-5
Control	1-3

Information Booklet

In addition to teaching the performance objectives and supporting competencies of the Technology Education courses teachers should review the following information booklet to ensure that students have been exposed to the concepts and principles presented.

Sample Examination Questions:

The following is a representative sample of questions selected from modules and topics within each Technology Education Systems course. Various cognitive levels of difficulty are included within the sample.

Communications Systems

The editing technique of making two or more copies of a film or sound tape is called

1. special effects
2. dubbing
3. mixing
*4. duplicating

Which is a system of sending a picture from a studio to a private home via wire?

*1. cable television
2. satellite television
3. UHF
4. VHF

In audio and audiovisual systems, the link between the transmitter and the receiver is

1. feedback
*2. the channel
3. noise
4. output

The structure of a television program is the

1. content idea
*2. format
3. script
4. storyboard

In the production of a printed product, copy that is a complete and accurate representation of the final product is referred to as

1. mechanical
2. rough
3. thumbnail
*4. camera ready

In the production of a leaflet, after the folding process the pages need to be

*1. trimmed
2. jogged
3. printed
4. collated

Which energy sources do graphic systems require?

*1. human, mechanical, and electrical
2. human, chemical, and mechanical
3. human, chemical, and electrical
4. chemical, electrical, and mechanical

On an offset press, the plate's image is direectly received by the

1. distribution roller
2. oscillating roller
3. plate cylinder
*4. blanket cylinder

Production Systems

Checking the air in a bicycle tire every week is an example of which type of service?

1. recall
2. installation
3. repair/reclamation
*4. preventive maintenance

Which group of experts would most likely be found at a product planning meeting?

1. sales, advertising, and servicing
2. maintenance, advertising, and production
3. engineering, maintenance, and servicing
*4. marketing, engineering, and production

Which step is part of preproduction planning?

*1. market survey
2. quality assurance
3. machine maintenance
4. packaging

Which part of an automobile is produced by the casting/molding process?

1. fender
*2. engine block
3. frame
4. axle

When a land survey of a parcel of land is done, the basic purpose is to determine the parcel's

1. purchase price
2. type of subsoil
3. surface characteristics
*4. location and size

The basic purpose of zoning laws is to

1. increase the community's tax revenues
*2. control the use of land
3. protect the safety of construction workers
4. keep construction costs to a minimum

How many squares of shingles would be needed to cover a porch roof that has a 16′ x 24′ shed style roof?

1. 1
2. 2
3. 3
*4. 4

A new city hall is to be constructed. Which type of contract and financing are most likely for this project?

*1. written contract and bonds
2. written contract and savings
3. negotiated contract and loans
4. verbal contract and mortgages

Transportation Systems

Which land transportation mode is highly efficient, but not as responsive to human needs as other modes?

*1. fixed route
2. random route
3. stationary conveyance
4. vehicular conveyance

The reduction of coefficient of drag has made it possible to produce automobiles that

1. accelerate
2. provide a more comfortable ride
*3. travel farther on less fuel
4. weigh more, but go faster

Most freight in the United States is moved by

*1. truck
2. car
3. barge
4. air

The most important engine invented and used during the 1800's for propulsion of ships was the

*1. steam engine
2. internal-combustion engine
3. rotary engine
4. two-cycle engine

A container ship is defined as a ship that transports

1. cargo placed in barrels
*2. cargo in sealed units
3. refrigerated products, only
4. fuel in liquid form, only

A gyroscope is part of an aircraft's

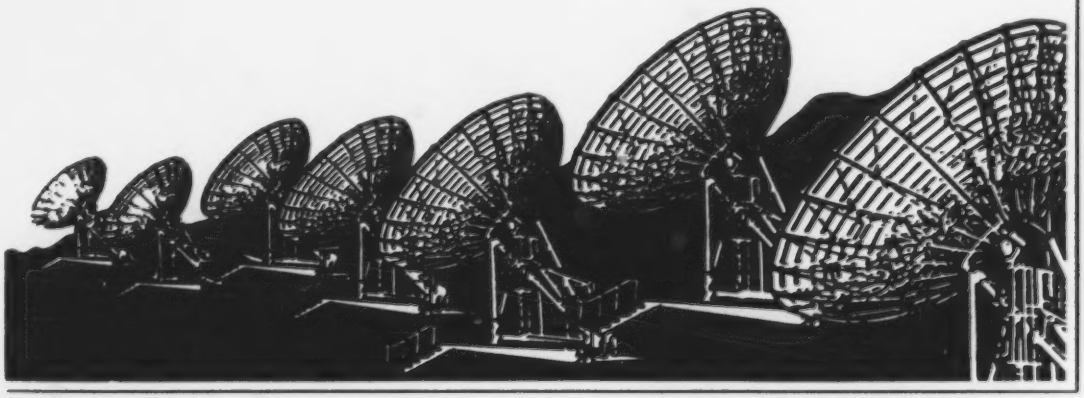
1. radar system
2. landing gear
*3. flight instruments
4. communications system

Air-cooled airplane engines are cooled by a system of

1. hoses and a radiator
2. engine-driven turbines
3. propeller-driven turbines
*4. fins, ducting, and cowling

TECHNOLOGY EDUCATION
COMMUNICATION SYSTEMS

GRADES 9-12
SYSTEMS BLOCK COURSE



COMMUNICATION SYSTEMS

Time allocated to each of the major topics, Imputs, Resources, Processes, Outputs, and Feedback/Control, must remain flexible; some overlapping will occur throughout the course. Weeks noted are approximate and serve as a guide to covering course content.

Inputs	1 week
A/AV Resources	2 weeks
Graphic Resources	2 weeks
A&AV Processes	6 weeks
Graphic Processes	6 weeks
Outputs	1/2 week
Control	1/2 week

Each of the proceeding performance objectives includes the corresponding page number of the course syllabus.

Also, following the number of each performance objective, you will find a list of questions and/or examples which directly correspond to the supporting competencies. The questions and examples should help the teacher clarify and understand the main focus of the performance objectives.

MODULE: A/AV

TOPIC: Inputs

PERFORMANCE OBJECTIVE: 1 — page 10

Explain...

a. Why do we communicate?
b. What determines types of messages?
c. What are markets?
d. What are medias and formats?
e. What is a logo? Why are symbols used instead of words?
f. Why should clients and professionals have meetings? List five examples of clients.

PERFORMANCE OBJECTIVE: 2 — page 10

Explain...

a. What resources and techniques are used in brainstorming?
b. How do specific technologies and techniques serve as solutions?
c. How can the solution be presented to the client?

PERFORMANCE OBJECTIVE: 3 — page 10

Explain...

a. How can a proposal be presented to a client?
b. How can A/AV formats be demonstrated?
c. How can a market be described?

TOPIC: Resources

PERFORMANCE OBJECTIVE: 1 — page 12

Define and Explain...

a. What events are important to the development of communications systems?
b. What inventions are important to the development of communications systems?
c. What are major A/AV processes?
   - Video
   - Compact/Laser Disc
   - Hi-Fidelity Stereo
   - Mini-cam and Still Video Recorders
   - Computerization of images
   - Halography
   - Photography
d. Define and describe a market analysis. How is it accomplished?

PERFORMANCE OBJECTIVE: 2 — page 12

Explain and Define...

a. What people work in the A/AV field? What is a chain of command?
b. What are these people's jobs wihtin the A/AV field?
   What do they do?
c. What did these people have to learn and know to do their job?
d. Explain why people are such an important resource in the A/AV field.

PERFORMANCE OBJECTIVE: 3 — page 12

Define...

a. What is a material resource? (e.g., props, costumes, tape)

Explain...

b. What are the material components of a production cycle?
c. Why are these materials components essential?

PERFORMANCE OBJECTIVE: 4— page 12

Define and Explain...

a. What are considered A/AV Systems?
b. What specific equipment is needed in each system?
c. What is a component? What is a Subsystem?
   Why is specific equipment *essential* in an A/AV System?
d. Why does A/AV industry use and seek state-of-the-art equipment?

PERFORMANCE OBJECTIVE: 5 — page 13

Explain...

a. How does size and location of a facility affect production?
b. List specific areas in an A/AV facility (e.g., studio, control room.)
c. Does the facility enhance or limit how a production is accomplished

PERFORMANCE OBJECTIVE: 6 — page 13

Explain...

a. What are common energy sources? (e.g., human, electrical, solar)
b. What are the consequences of energy shortages? How are Electrical Expenses Calculated? What are the consequences of energy shortages?
c. How can alternative energy sources be used to power A/AV equipment?
d. What is a component? What is a subsystem?

PERFORMANCE OBJECTIVE: 7 — page 13

a. How is time allocated to various stages of the production process?
b. Why are deadlines important throughout the production process?
c. Why do managers establish production schedules for individual products/contracts?
d.. What are the consequences of inefficient use of time?

PERFORMANCE OBJECTIVE: 8 — page 13

Define and Explain...

a. What are the costs of resources and how are they paid for?
b. Describe how various sources of capital are obtained.
c. How does adequate capital affect A/AV operations?

TOPIC: Process

PERFORMANCE OBJECTIVE: 1 — page 17

Explain...

a. How to develop an idea that has client approval.
b. How to identify a working procedure for implementing an approved solution.
c. How to develop a script storyboard. What does one look like?
d. What is the significance of the client's approval?
e. What does a production schedule look like?

PERFORMANCE OBJECTIVE: 2 — page 17

Explain...

a. What are the job titles necessary for production?
b. What materials are necessary? (e.g., props, costumes)
c. How to set-up and operate production equipment.
d. How to identify and set-up staging for production.

PERFORMANCE OBJECTIVE: 3 — page 17

Explain...

a. How to set up a production.
b. How to continue production with absent personnel.
c. When should a script/storyboard be modified?
d. What are the production differences between recorded and live broadcasts?

PERFORMANCE OBJECTIVE: 4 — page 17

Explain...

a. How mixing is done. How long does mixing take?
b. What is dubbing and how is it done?
c. What is the best way of copying the product?

PERFORMANCE OBJECTIVE: 5 — page 18

Explain...

a. Who sets standards for quality?
b. What is the purpose of monitoring?
c. How is monitoring done? Human, judgement?
d. Why is monitoring done at a given time?
e. How are monitoring skills learned?

TOPIC: Outputs

PERFORMANCE OBJECTIVE: 1 — page 21

a. Using brainstorming, explain and define the purpose of packaging a particular product.
b. Using brainstorming, explain and define a market and a marketing strategy.

PERFORMANCE OBJECTIVE: 2 — page 21

a. What is an impact? List examples of positive and negative impacts.
b. What is meant by a personal impact of a product?
c. How do we define economical, local, national, global? Give an example of an economic impact of a local, national, and global A/AV product.
d. How have A/AV products affected social behavior?

TOPIC: Feedback/Control

PERFORMANCE OBJECTIVE: 1 — page 23

Explain...

a. How is the product evaluated by people and what effect does this have on the product?
b. At what production stages should a client interact and provide feedback?

PERFORMANCE OBJECTIVE: 2 — page 23

Explain...

a. What are mechanical and instrumental monitoring devices?
b. What instrumental devices can be used to monitor A/AV systems?
c. What mechanical devices can be used to monitor A/AV systems?

PERFORMANCE OBJECTIVE: 3 — page 23

Explain...

a. What are automatic controls? How are they used?
b. How can computers and computer programs be used for A/AV production?
c. List several A/AV processes where automatic control is used.

MODULE: Graphics

TOPIC: Inputs

PERFORMANCE OBJECTIVE: 1 — page 30

a. Why do we communicate
b. What determines types of messages?
c. What are markets?
d. What are media and formats?
e. What is a logo? Why are symbols used instead of words?
f. Why should clients and professionals have meetings?

PERFORMANCE OBJECTIVE: 2 — page 30

a. What resources are used primarily in brainstorming?
b. How do specific technologies and techniques serve as solutions?
c. How can the solution be presented to the client?

PERFORMANCE OBJECTIVE: 3 — page 30

a. How can a proposal be presented to a client?
b. How can various formats, such as booklets, brochures, and flyers, be represented in a client/designer discussion?
c. How can a market be described?

TOPIC: Resources

PERFORMANCE OBJECTIVE: 1 — page 33

a. What developments have been significant in the history of Graphic Systems?
b. What new and emerging technologies are changing Graphic Systems?
c. What are the major image transfer systems?
d. What factors influence a designer's selection of a printing method for a product?

PERFORMANCE OBJECTIVE: 2 — page 33

a. What is a hierarchical chart in industry? What is a chain of command and responsibility
b. What is a job description of each position in a printing firm?
c. What training (e.g., high school, on the job, trade school, or college) is required for positions in the Graphics Industry?
d. What is the anticipated career market and what opportunities exist in the Graphics Industry?

PERFORMANCE OBJECTIVE: 3 — page 33

a. What types of materials are used in Graphic Systems?
b. What materials and supplies must be shipped to and made available at the production site?
c. What are the consequences of supply shortages in the production cycle?

PERFORMANCE OBJECTIVE: 4 — page 33

a. What are the major printing processes?
b. What major equipment is required for each Graphic System? (e.g., offset press for offset printing, stencil exposure system for screen printing)
c. What are the components of equipment lines in each Graphic System?
d. Why do printing firms seek state of the art equipment?

PERFORMANCE OBJECTIVE: 5 — page 34

a. What features must be included in a facility that houses Graphic Systems?
b. What special areas are dedicated to processes within Graphic Systems? (e.g., darkroom, platemaking, design studio)
c. What types of overhead costs are associated with the facility?

PERFORMANCE OBJECTIVE: 6 — page 34

a. What energy sources are used in Graphic Systems?
b. How can energy be conserved? How are costs calculated?
c. How could new/alternative energy sources be used in Graphic Systems?

PERFORMANCE OBJECTIVE: 7 — page 34

a. How is time allocated to various stages of the production process?
b. Why are deadlines important throughout the manufacturing process?
c. Why do managers establish production schedules for individual products/contracts?

PERFORMANCE OBJECTIVE: 8 — page 34

a. How do the costs of resources affect planning and producing a product?
b. How can a printing firm raise capital for operating expenses and expansion purchases?
c. How does adequate capital promote an enterprise and what are effects of insufficient funds?

TOPIC: Processes

PERFORMANCE OBJECTIVE: 1 — page 38

a. What are thumbnail sketches and how do they encourage new ideas?
b. How do elements of design strengthen various plans?
c. What specifications are shown on roughs and dummies?
d. How can proposals be effectively presented to the customer?
e. Why must the due date be preceded by a production schedule?

PERFORMANCE OBJECTIVE: 2 — page 38

a. How can images be generated using modern techiques?
b. In what ways can images be moved and positioned per specifications?
c. How are images converted to film or plate?
d. In what ways are plates produced for the major printing processes?

PERFORMANCE OBJECTIVE: 3— page 38

a. What are the major systems common to all image transfer equipment? (feed, register, imaging, delivery)
b. How is the process of registration both important and accomplished in image transfer systems and why is it important?
c. How is the master image transferred to the blank surface?
d. How are manufactured sets of printed materials handled after image transfer?

PERFORMANCE OBJECTIVE: 4 — page 39

a. What are the advantages of machine folding over manual folding?
b. What is meant by collating?
c. How can pages be bound?
d. What role do trim lines and size specifications play in the finishing process?

PERFORMANCE OBJECTIVE: 5 — page 39

a. What characteristics do Graphic professionals and customers look for in Graphic Communications?
b. How does quality control insure production standards?
c. How is quality control maintained by monitoring various systems?
d. At what points in the production cycle should monitoring occur?
e. Is quality control a separate process and department or combined with production? How are monitoring skills learned?

TOPIC: Outputs

PERFORMANCE OBJECTIVE: 1 — page 42

a. What types of packaging solutions are used to deliver products?
b. How can a printed product be presented to consumers so as to promote purchase or use?

PERFORMANCE OBJECTIVE: 2 — page 42

a. How do the use and disposal of printed products affect the environment?
b. In what ways do mass communications affect our daily lives?
c. In what ways do mass communications affect personal, government, and private enterprise?
d. In what ways do mass communications affect world literacy, cultural awareness, and global interaction?

TOPIC: Feedback/Control

PERFORMANCE OBJECTIVE: 1 — page 44

a. How does human feedback affect the design process?
b. Why is it important to consult with the client during the design process?

PERFORMANCE OBJECTIVE: 2 — page 44

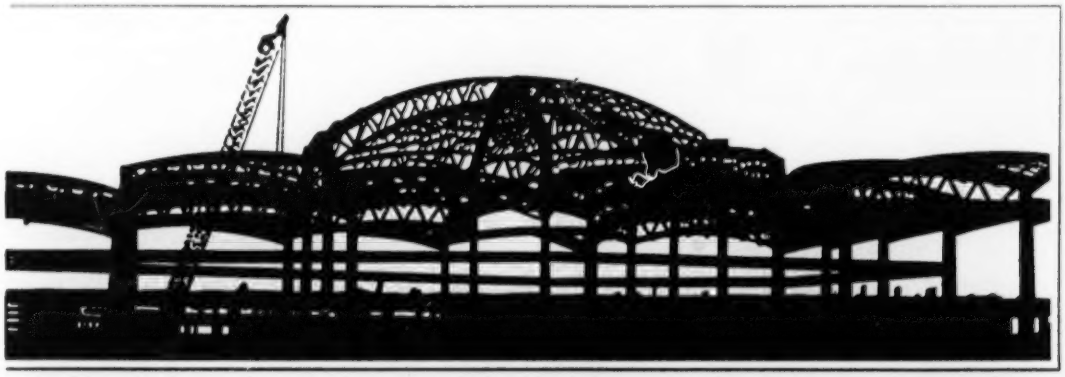
a. How does program feedback control the process of Graphic Output?
b. What devices are used to control Graphic Systems?
c. What mechanical means are used to control Graphic Systems?

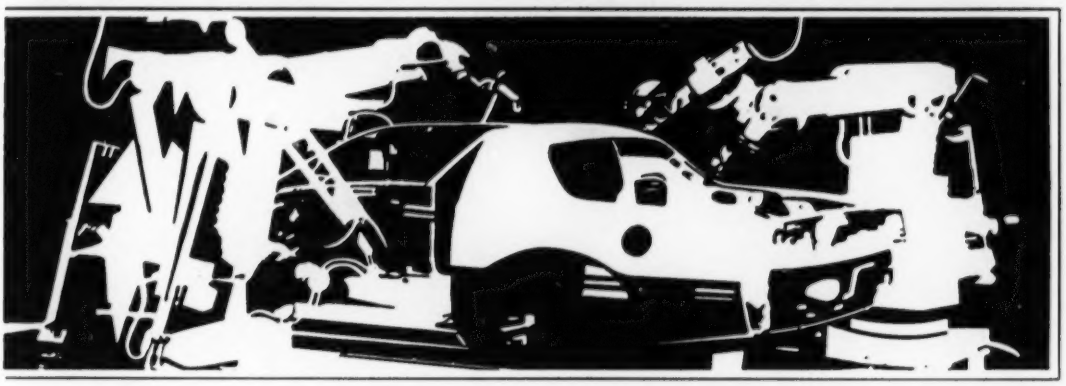
PERFORMANCE OBJECTIVE: 3 — page 44

a. How does automatic feedback control the output of Graphic Systems?
b. How can computers and computer programs be used to monitor output?
c. At what point in the production processes should automatic feedback be used?

TECHNOLOGY EDUCATION
PRODUCTION SYSTEMS

GRADES 9-12
SYSTEMS BLOCK COURSE





MODULE: Basic Systems of Manufacturing

TOPIC: System

PERFORMANCE OBJECTIVE: 1 Goal for manufacturing enterprise, page 11

Students must know why:
a. This product was chosen to meet space, cost, etc.
b. Specifications are necessary to identify materials and information from the working drawings.
c. Planning is required before production — identify costs and procedures.

APPROXIMATE TIME: 45 MINUTES

PERFORMANCE OBJECTIVE: 2 Possible impacts, page 11

Students must know why:
a. The results and effects of manufacturing are significant - - to individuals, communities, and resources.
b. Research is necessary to identify the results and effects of manufacturing on individuals, communities, and resources.

APPROXIMATE TIME: 15 MINUTES

TOPIC: Resources

PERFORMANCE OBJECTIVE: 1 Personnel as a resource, page 13

Students must know why:
a. Types of jobs and career requirements are important — education, training, and opportunities.
b. Personnel organization and assignments are significant — supervision, reporting, and lines of authority.
c. Qualified personnel is required — attitudes, preparation, and abilities.

APPROXIMATE TIME: 45 MINUTES

PERFORMANCE OBJECTIVE: 2 Information as a resource, page 13

Students must know:
a. Some of the significant historical developments from handcraft to mechanization to automation.
b. The importance of safe laboratory procedures; actual safety procedures will be taught with each activity and operation.
c. What role research and development play in the manufacture of the product. (Minimize student activity in research and development since it is time consuming.)

APPROXIMATE TIME: 45 MINUTES

PERFORMANCE OBJECTIVE: 3 Materials as a resource, page 131

Students must know:

a. The sources of some common materials used in manufacturing, for example:
   - Wood
   - Metal
   - Plastics
   - Ceramics
   - Composites

b. How selected raw materials are transformed into industrial materials, e.g., trees to lumber and petroleum to polymers.

c. Some sources and procedures for obtaining materials, e.g., catalogs and supply stores.

d. What physical characteristics determine the actual selection of materials.

APPROXIMATE TIME: 30 MINUTES

PERFORMANCE OBJECTIVE: 4 Tools and machines, page 13

Students must know:

a. Why and how to use selected tools and machines.

b. How to use selected tools and equipment safely. (No student will use every tool and/or machine.)

c. How to care for selected tools and equipment to ensure effective and safe use.

APPROXIMATE TIME: 240 MINUTES

PERFORMANCE OBJECTIVE: 5 Capital as a resource, page 14

Students must know:

a. Various sources of funding — banks, private investors, and stocks.

b. The procedures and systems for keeping financial records and accounts.

APPROXIMATE TIME: 30 MINUTES

PERFORMANCE OBJECTIVE: 6 Energy as a resource, page 14

Students must know:

a. What types of energy will be used for manufacturing, for example:
   - Electricity
   - Gas
   - Solar
   - Oil

b. Why certain energy sources are selected, e.g., cost, availibility, and application.

APPROXIMATE TIME: 30 MINUTES

PERFORMANCE OBJECTIVE: 7 Time as a resource, page 14

Students must know:

a. What determines the time availability for the manufacturing process.

b. What management techniques are used to manufacture effectively and efficiently, for example:
   - Time management
   - Resources
   - Process selection

APPROXIMATE TIME: 60 MINUTES

TOPIC: Processes

PERFORMANCE OBJECTIVE: 1 Forming materials, page 20

Students must know and demonstrate:

a. The appropriate casting and molding techniques, e.g., liquid to solid form.
b. Selected compressing and stretching techniques, e.g., sheet metal, forming and polymer bending, and wood lamination.

APPROXIMATE TIME: 60 MINUTES
More time may be required depending on the types of processes used during manufacturing.

PERFORMANCE OBJECTIVE: 2 Separating materials, page 20

Students must know and demonstrate:

a. Shearing techniques that involve the separation of materials without the formation of chips, e.g., die punching and sheet metal shearing.
b. Chip removal processes that involve the separation of materials and production of waste (chips), e.g., sawing, drilling, turning.
c. Non-traditional methods of separating materials that are used in manufacturing, e.g., laser, E.D.M., E.C.M., and etching.

APPROXIMATE TIME: 480 MINUTES
The amount of time required will vary depending on the types of processes used during manufacturing.

PERFORMANCE OBJECTIVE: 3 Combining materials, page 20

Students must know and demonstrate various combining processes:

a. Mechanical fastening:
   - Nails
   - Screws
   - Bolts
   - Rivets

b. Adhering:
   - Epoxy
   - Brazing
   - Glues
   - Soldering

   Cohering
   - Lamination using heat
   - Welding
   - Solvent cementing (P.V.C. pipe)

c. Mixing:
   - Formulating glazes
   - Plaster
   - Concrete
   - Resins

d. Coating:
   - Painting
   - Silk screening
   - Plating

e. Assembling — Fabrication of piece parts into subassemblies of final assemblies.

APPROXIMATE TIME: 240 MINUTES
The amount of time required will vary depending on the types of processes used during manufacturing.

PERFORMANCE OBJECTIVE: 4 Conditioning process, page 20

Students must know:

a. The types of conditioning techniques:
   - Thermal, e.g., heat treating
   - Chemical, e.g., etching
   - Mechanical, e.g., rolling, hammering
   - Combination, e.g., tempered hard board and composition boards

b. Classroom techniques selected by the teacher.

APPROXIMATE TIME: 60 MINUTES

More time may be required depending on the types of processes used during manufacturing.

TOPIC: Outputs

PERFORMANCE OBJECTIVE: 1 Packaging, distribution, reclaiming, servicing, page 24

Students must know:

a. Why products are packaged for consumer appeal, security, and customer safety.
b. Systems used for product distribution, e.g., direct, wholesale, and retail.
c. What to do with used manufactured products, for example:
   - Reuse — refill glass bottles
   - Reclaim — melt aluminum cans
d. Significance of servicing, e.g., preventive maintenance and repair

APPROXIMATE TIME: 30 MINUTES

Note: Ideal as a homework assignment to accompany processing objectives and the number 2 inputs objective.

PERFORMANCE OBJECTIVE: 2 Environmental, economic, societal, and personal impacts, page 24

Students must know the effects manufacturing can have on the following equipment:

a. Environment — pollution or improved water systems.
b. Economy — capital investment in the community.
c. Society — good neighbor, community supporter.
d. Personal — employment.

APPROXIMATE TIME: 30 MINUTES

Note: Ideal as a homework assignment to accompany processing objectives and the number 2 inputs objective.

TOPIC: Control

PERFORMANCE OBJECTIVE: 1 Reasons for controlling resources, page 27

Students must know why it is necessary to control the seven (7) resources used in manufacturing:

a. Quality assurance — to create and maintain sales.
b. Profitability — to insure cost effectiveness and continued production.

APPROXIMATE TIME: 90 MINUTES

Note: This objective is best taught in conjunction with other previously identified objectives.

PERFORMANCE OBJECTIVE: 2 Methods of controlling resources, page 27

Students must know the specific methods with which to control the seven (7) resources used in production:

a. Monitoring — observe and measure quality.
b. Comparison — determine if the product falls within established standards.
c. Adjustment — modify the processes within acceptable standards.

APPROXIMATE TIME: 90 MINUTES

Note: This objective is best taught in conjunction with other previously identified objectives.

MODULE: Basic Systems of Construction

TOPIC: System Command Input

PERFORMANCE OBJECTIVE: 1 Goal for construction projects, page 39

Students must know why:

a. This project was chosen — to meet consumer need, space, cost, etc.
b. Specifications are necessary — to identify material and information from the working drawings.
c. Planning is required before production — to identify costs and procedures.

APPROXIMATE TIME: 45 MINUTES

PERFORMANCE OBJECTIVE: 2 Possible impacts of construction project, page 39

Students must know why:

a. The results and effects of construction activities are significant — to individuals, communities, and resources.
b. Forcasting is necessary to identify the results and effects of construction projects on individuals, communities, and resources.

APPROXIMATE TIME: 15 MINUTES

TOPIC: Resources

PERFORMANCE OBJECTIVE: 1 Personnel as a resource, page 41

Students must know why:

a. Types of jobs and career requirements are important — education, training, and opportunities.
b. Personnel organization and assignments are significant — supervision, reporting, and lines of authority.
c. Qualified personnel is required — attitudes, preparation, and abilities.

APPROXIMATE TIME: 45 MINUTES

PERFORMANCE OBJECTIVE: 2 Information as a resource, page 41

Students must know:

a. Some of the significant historical developments of construction throughout history, for example:
   - Stick to prefab
   - Use of Portland cement
   - Architectural design

b. The importance of safe laboratory procedures; actual safety procedures will be taught with each activity and operation.

c. What role research and development play in construction projects, e.g., materials, designs, and techniques.

APPROXIMATE TIME: 45 MINUTES

PERFORMANCE OBJECTIVE: 3 Materials as a resource, page 41

Students must know:

a. The source of some common raw materials used in construction projects:
   - Forest
   - Mines

b. How selected raw materials are transformed into industrial materials, e.g., trees to lumber and petroleum to polymers.

c. Some sources and procedures for obtaining materials, e.g., catalogs and supply stores.

d. What physical characteristics determine the actual selection of materials.

APPROXIMATE TIME: 30 MINUTES

PERFORMANCE OBJECTIVE: 4 Tools and machines as a resource, page 41

Students must know:

a. Why and how to use selected tools and machines.

b. How to use selected tools and equipment safely. (No student will use every tool and/or machine.)

c. How to care for selected tools and equipment to ensure effective and safe use.

APPROXIMATE TIME: 240 MINUTES

PERFORMANCE OBJECTIVE: 5 Capital as a resource, page 42

Students must know:

a. Various sources of funding, for example:
   - Banks
   - Private investors
   - Stocks

b. The procedures and systems used for keeping financial records and accounts.

APPROXIMATE TIME: 30 MINUTES

PERFORMANCE OBJECTIVE: 6 Energy as a resource, page 42

Student must know:

a. What types of energy will be used for construction activities, for example:
   - Electricity
   - Gas
   - Oil

b. Why certain energy applications are selected, for example:
   - Cost
   - Availability
   - Portability

APPROXIMATE TIME: 30 MINUTES

PERFORMANCE OBJECTIVE: 7 Time as a resource, page 49 (P.O. 3, page 49 should be P.O. 7 and follow P.O. 6 on page 42)

Students must know:

a. What determines the time availability for the construction activities.

b. What management techniques are utilized to construct effectively and efficiently:
   - Time management
   - Personnel selection
   - Process selection

APPROXIMATE TIME: 60 MINUTES

TOPIC: Processes

PERFORMANCE OBJECTIVE: 1 Foundation system, page 46

Students must know:

a. Various characteristics of materials used in foundations, for example:
   - Pressure treated lumber
   - Masonry

b. Techniques used in constructing foundations, for example:
   - Poring
   - Laying block
   - All-weather wood

APPROXIMATE TIME: 60 MINUTES
More time may be required depending on the types of processes use during construction.

PERFORMANCE OBJECTIVE: 2 Superstructure, page 46

Students must know:

a. Various materials used in framing systems, for example:
   - Wood
   - Steel
   - Concrete

b. The physical properties and application of various materials used in framing systems, for example:
    Concrete
    Lumber
    Metal

APPROXIMATE TIME: 480 MINUTES
The amount of time will vary depending on the types of processes used during construction.

PERFORMANCE OBJECTIVE: 3 Enclosure system, page 46

Students must know:

a. Why enclosure systems are essential to construction projects, for example:
    Floors
    Walls
    Roofs
    Doors
    Windows
b. How, and what, materials are used for floors, walls, and roofs, for example:
    Plywood
    Drywall
    Shingles
c. The significance of insulation materials and their installation in enclosure systems.

APPROXIMATE TIME: 240 MINUTES
The amount of time required will vary depending on the types of processes used during construction.

PERFORMANCE OBJECTIVE: 4 Electrical, plumbing, heating/cooling, and communications systems, page 46

Students must know:

a. The significance and application of mechanical systems in construction projects, for example:
    Installation of wiring
    Piping
    Ducts
b. The criteria for selecting a specific mechanical system, for example:
    Septic system vs. sewers
    Oil
    Electricity
    Water sources

APPROXIMATE TIME: 60 MINUTES
More time may be required depending on the types of processes used during construction.

TOPIC: Outputs

PERFORMANCE OBJECTIVE: 1 Site completion and project maintenance, page 49

Students must know:

a. What tasks must be performed to clean and prepare the site before the owner accepts the project, for example:
   - Waste removal
   - Landscaping
   - Removal of construction tools and equipment

b. Why preventive maintenance is essential to the longevity and the efficient operation of systems in the facility, for example:
   - Painting
   - Cleaning
   - General repairs

APPROXIMATE TIME: 30 MINUTES
Note: Ideal as a homework assignment.

PERFORMANCE OBJECTIVE: Environmental, economic, societal, and personal, page 49

Students must know the potential effects of construction on the following elements:

a. Environment — e.g., improved property value; increased traffic congestion
b. Economy — e.g., improved or decreased business opportunities
c. Society — e.g., improved facilities; community support group through construction and participation
d. Personal — e.g., employment; opportunity

APPROXIMATE TIME: 30 MINUTES
Note: Ideal as a homework assignment.

TOPIC: Control

PERFORMANCE OBJECTIVE: 1 Reasons for controlling resources, page 52

Students must know why it is necessary to control the seven (7) resources used in construction activities:

a. Quality assurance — to create additional markets and sales opportunities.
b. Profitability — to insure cost effectiveness and additional project opportunities.

APPROXIMATE TIME: 90 MINUTES
This objective is best taught in conjunction with other previously identified objectives.

PERFORMANCE OBJECTIVE: 2 Methods for controlling resources, page 52

Students must know the specific methods with which to control the seven (7) resources used in construction activities:

a. Periodic inspections to satisfy state and local building codes.
b. Comparison — determining if the project is within established standards.
c. Adjustments — modifying the project to comply with acceptable standards of production.

APPROXIMATE TIME: 90 MINUTES
This objective, however, is best taught in conjunction with other previously identified objectives.

TECHNOLOGY EDUCATION
TRANSPORTATION SYSTEMS

GRADES 9-12
SYSTEMS BLOCK COURSE

TRANSPORTATION SYSTEMS:

MODULE: Land

TOPIC: Inputs

PERFORMANCE OBJECTIVE: 1 — page 9

Students must know:

a. Systems or methods that land transportation vehicles use in order to move people and goods efficiently, for example:
   - Production systems
   - Suspension systems
   - Compartments
   - Communication systems
   - Safety regulations

   How to explain safety as it relates to land transportation systems, for example:
   - Periodic inspection of bridges
   - Periodic inspection of all vehicles
   - Need of traffic signals

b. The physical limitations of man, for example:
   - Strength
   - Reflexes
   - Sight

   How pulleys, levers, and machines are evident in land transportation, for example:
   - Monorail
   - Ski lift
   - Gear boxes

c. Where human locomotion, sledge, wheel, external combustion, internal combustion, and other energy sources, fit into a time line.
   How various land transportation vehicles compare in relation to materials, methods of construction, power sources, suspension systems, etc.

APPROXIMATE TIME: 120 MINUTES

TOPIC: Resources

PERFORMANCE OBJECTIVE: 1 — page 10

Students must know:

a. How selected land transportation jobs compare, concerning the following:
   - Skills needed
   - Education
   - Responsibilities
   - Projected salaries
   - Working conditions

b. The entry level requirements for a selected career, for example:
   - Truck driver/long haul — age, license, eyesight, etc.

PERFORMANCE OBJECTIVE: 2— page 10

Students must know:

a. How to become proficient in using road maps, for example:
   - Legend
   - Mileage
   - Plotting a trip

b. How a compass works. How a com[illegible] can assist the land traveler. How to recognize compass error, for example:
   - Magnetic variation
   - Magnetic deviation

c. Where and how Ham Radios, Citizen Band Radios, Cellular Car Phones, etc., are used in land travel communication.

d. How road signs, markers, surrounding terrain, etc., play a part in dead reckoning.

e. How to effectively use an owner's manual (car) for proper care and maintenance, for example:
   - Oil change
   - Break in period

APPROXIMATE TIME: 90 MINUTES

PERFORMANCE OBJECTIVE: 3 — page 10

Students must know:

a. Steps to take to develop a land vehicle, for example:
   - Idea or concept designs
   - Final drawings
   - Power Plant
   - Materials of construction methods
   - Prototype testing

b. What design limitations to place on land vehicle construction, for example:
   - Size
   - Weight
   - Materials
   - Power plant

   The equipment and tools needed to complete this vehicle, for example:
   - Drill press
   - Power sander
   - Band saw
   - Glue clamps
   - Computer
   - Wind Tunnel

APPROXIMATE TIME: 350 MINUTES

PERFORMANCE OBJECTIVE: 4 — page 10

Students must know:

a. What investments will be required of a given transportation system, for example:

Buses —	Energy:	Fuel
	Time:	Man hours
		Schedules
		Vehicle hours
	Capital:	Vehicle costs
		Inventory
		Worker wages
		Garage facility expenses

b. How to associate the resources of capital, energy , and time to the development of a system, for example:

Students can list from their model building experience, and research the requirements of capital, energy and, time for a selected system.

APPROXIMATE TIME: 20 MINUTES

TOPIC: Process

PERFORMANCE OBJECTIVE: 1 — page 13

Students must know:

a. The fundamental differences among the three modes of land transportation, for example:
   - Fixed route vehicle — train
   - Random route vehicle — automobile
   - Stationary conveyance — elevator

   The specific components that makeup the modes of land transportation, for example:
   - Land vehicle — pipeline monorails
   - Solar power car
   - Elevators

APPROXIMATE TIME: 480 MINUTES

PERFORMANCE OBJECTIVE: 2 — page 13

Students must know:

a. The subsystem comon to land vehicles, for example:
   - Propulsion System — engine
   - Structural System — frame

b. The function of each vehicle's subsystem in relation of its overall function, for example:
   - Frame (structural) strength

c. The recommended maintenance and repair procedures for vehicle subsystems, for example:
   - Oil change
   - Vehicle lubrication
   - Proper tire inflation

APPROXIMATE TIME: 120 MINUTES

TOPIC: Output

PERFORMANCE OBJECTIVE: 1 — page 15

Students must know:

a. The costs per ton for transporting 10 tons of bulk material (e.g., coal, fertilizer) 100 miles by each of the methods below:
   1/2 ton pick-up truck
   10 ton dump truck

b. The major transportation systems used in developing nations, for example:
   - Human
   - Beast of burden
   - Rail

   The shortcomings of the above systems, for example:
   - Efficiency
   - Access

   Whether this has an effect on this country's economy, for example:
   - Transporting perishable goods
   - Exporting commodites

APPROXIMATE TIME: 60 MINUTES

PERFORMANCE OBJECTIVE: 2 — page 15

Students must know:

a. The environmental effects of using a fossil fuel for vehicles, for example:
   - Sulfur dioxide
   - Carbon monoxide

b. The commonly used resources for supporting transportation systems (e.g., oil, steel). Where these resources are located and how long they will last at their current rate of consumption, for example:
   - Oil — Saudia Arabia, 50 years

APPROXIMATE TIME: 30 MINUTES

PERFORMANCE OBJECTIVE: 3 — page 15

Students must know:

a. What services are provided by the N.Y.S. Consumer Protection Board and the Attorney General's Office, for example:
   - The Lemon Law
   - Automobile Safety Practices
   - Motor Vehicle Department
   - Publication

b. How to determine the total cost for an oil change and lubrication, servicing done by local service stations, for example:
   - Compare newspaper advertisements
   - Compare consumer reports

c. The regulations concerning the use of ATV's on public lands in New York State, for example:
   - Safety requirements
   - Age requirements

APPROXIMATE TIME: 30 MINUTES

TOPIC: Monitor/Control

PERFORMANCE OBJECTIVE: 1 — page 18

Students must know:

a. How a driver monitors the speed of an automobile, for example:
   - Brake
   - Eye
   - Speedometer
   - Accelerator

b. How to use information received from simple monitor and control devices to make decisions and/or adjustments, for example:
   - Oil pressure gauge
   - Fuel gauge
   - Compass

c. Some commonly used automatic vehicle control systems, for example:
   - Cruise control
   - Computer command control
   - Electronic fuel injection

APPROXIMATE TIME: 120 MINUTES

MODULE: Marine

TOPIC: Inputs

PERFORMANCE OBJECTIVE: 1 — page 27

Students must know:

a. When the following significant marine inventions occured:
   - Dugout canoe
   - Square sail
   - Lateen sail
   - Steamboat
   - Propeller
   - All-steel ship
   - Nuclear powered ship

b. The physical makeup of the following marine vessels:
   - Dugout canoe
   - Reed boat
   - Spanish galleon
   - Cargo vessel
   - Oil tanker
   - Holland's submarine

APPROXIMATE TIME: 60 MINUTES

TOPIC: Resource

PERFORMANCE OBJECTIVE: 1 — page 28

Students must know:

a. Some examples of Marine Hulls, such as:
   - Displacement
   - Planing
   - Catamaran
   - Trihull

b. What safety precautions are necessary when using reinforced plastics, for example:
   - Gloves
   - Adequate ventilation
   - Eye protection
   - Proper storage

c. How to select and safely use the materials and tools to produce a Boat Hull, for example:
   - Efficiency
   - Hydro-dynamics
   - Displacement calculation
   - Stability

APPROXIMATE TIME: 240 MINUTES

TOPIC: Process

PERFORMANCE OBJECTIVE: 1 — page 29

Students must know:

a. How a Marine vessel can be inspected for its condition.
   For example, look for the following:

Dents	Paint condition
Cracks	Marine growth
Punctures	Rot
Smoothness	

b. How to follow a standard maintenance procedure for a marine vessel, for example:
   Follow a devised work sheet developed from an owner's manual
c. How to demonstrate the following on boat hulls or hull mockups:
   Algae removal, proper use of cleaning and rubbing compounds and waste
   Basic fiber glass repair
   Caulking and patching techniques
d. Where tools and unused materials are stored in the laboratory and on marine vessels, for example:
   Maintenance tools
   Chemical compounds
   Extra fuel
e. How to perform or decribe "winterizing" procedures, for example:
   Remove engine coolant and oil exposed parts
   Empty fuel tank and fuel lines
   Lubricate moving parts
f. How to demonstrate "spring ready" techniques, for example:
   Lubricate moving parts
   Add engine coolant
   Add fresh fuel
   Grease lower unit
   Check hydraulic fluid level

APPROXIMATE TIME: 120 MINUTES

PERFORMANCE OBJECTIVE: 2 — page 29

Students must know:

a. How to identify and describe subsystems of a given marine propulsion system, for example:

Lubrication	Charging
Cooling	Drive train
Ignition	Fuel

b. How to demonstrate an understanding of marine propulsion subsystems by giving examples, such as: **Lubrication** — oil is splashed and/or pumped to bearings, crank shaft, pistons, and other moving parts to maintain smooth, efficient, trouble-free operation.
c. How to effectively follow through trouble shooting procedures on an internal combustion engine, for example, follow an instructor developed work sheet.

APPROXIMATE TIME: 120 MINUTES

TOPIC: Outputs

PERFORMANCE OBJECTIVE: 1 — page 31

Students must know:

a. Some short-term environmental impacts of Marine Transportation, for example:
   - Oil spills
   - Wake damage

   Some long-term environmental impacts of Marine Transportation, for example:
   - Canal, marine, and harbor construction
   - Shoreline deterioration
   - Water pollution

b. Some steps that could minimize negative environmental impacts stemming from recreational boating, for example:
   - Use a chemical toilet
   - Minimize fuel spills
   - Eliminate litter
   - Slow down to minimize wake damage

APPROXIMATE TIME: 30 MINUTES

PERFORMANCE OBJECTIVE: 2 — page 31

Students must know:

a. The New York State Boating Laws, for example:
   - Speed limits
   - Power boat operators
   - Minimum age
   - Vessel registration

b. The minimum standards for safety equipment required for recreational marine vessels as required by the U.S. Coast Guard, for example:
   - Lights
   - Personal floatation devices
   - Fire extinguishers
   - Soundig devices

c. Safe operating procedures for recreational boating, for example:
   - Human and sail powered craft have the right of way.
   - Pass starboard to starboard when approaching head on.
   - Use bilge blowers before starting inboard.

APPROXIMATE TIME: 150 MINUTES

TOPIC: Monitor/Control

PERFORMANCE OBJECTIVE: 1 — page 33

Students must know:

a. Why it is important to monitor recreational boating gauges/instruments, for example:
   - Compass-direction
   - Oil pressure-engine
   - Monitoring

b. What instrumentation basic Land, Marine, and Aerospace Transporation Vehicles have in common, for example:
   - Tachometer — engine RPM
   - Compass — directional heading
   - Oil Pressure — 4 cycle engines lubrication
   - Tempurature gauge — coolant or head temperature

APPROXIMATE TIME: 60 MINUTES

MODULE: Aerospace

TOPIC: Resources

PERFORMANCE OBJECTIVE: 1 — page 40

Students must know:

a. Some examples of transitional Aviation/Aerospace Vehicles, for example:
   - Montgolfier's Hot Air Ballon
   - Wright Brothers'- flyer
   - Voyager space shuttle

b. Some of the key events that expanded Aerospace growth, for example:
   - Lindburg's Atlantic Flight
   - Wright Brothers' 1903 Flights
   - Double Eagle II (helium ballon) crossing the Atlantic
   - Apollo landing on the moon

c. Some of the individuals who made significant contributions to Aviation/Aerospace, for example:
   - Montogolfier Brothers
   - Sir George Cayler
   - Robert Goddard
   - Werner Von Braun
   - Burt Rutan
   - Paul McReady

d. Some of the societal impacts of Aerospace Technology, for example:
   - Fast transportation to anywhere in the world
   - New materials
   - Innovative manufacturing techniques
   - Microcomputers

APPROXIMATE TIME: 60 MINUTES

TOPIC: Resources

PERFORMANCE OBJECTIVE: 1 — page 41

Students must know:

a. The characteristics of materials used for Aerospace Vehicle Construction, for example:
   - Wood
   - Fabric
   - Aluminum
   - Graphite
   - Reinforced plastics
   - Kevlar
   - Ceramics

b. The energy requirements for a aircraft construction, for example:
   - Electric motor
   - Pneumatics
   - Hydraulics

   The energy requirements for operating aircraft, for example:
   - Servos
   - Hydraulics
   - Turbines
   - Reciprocating Engines
   - Solar power

c. Some of the tools, machines, and operations necessary for constructing aerospace vehicles, for example:
   - Riveting
   - Robots
   - Numerical control machine tools
   - Sheet metal punches and shears
   - Grinders

APPROXIMATE TIME: 200 MINUTES

PERFORMANCE OBJECTIVE: 2 — page 41

Students must know:

a. How the Venturi Effect relates to the force of lift on an air foil, for example:
   Increased air speed over curved surfaces will decrease air pressure.
b. How the Bernoullis principle applies to the forces of flight, for example:
   Increased speed creates low pressure on top of the air foil; the resulting force on the bottom of the air foil exceeds the force on top of the air foil, and the airfoil rises.
c. How Newton's 3rd Law "For every action there is an equal and opposite reaction:" relates to the lifting phenomenon, for example:
   As the relative wind strikes an air foil, the relative wind is deflected downward and the air foil is pushed upward.
d. The 4 forces of level flight:
   Thrust
   Drag
   Lift
   gravity

APPROXIMATE TIME: 40 MINUTES

TOPIC: Process

PERFORMANCE OBJECTIVE: 1 — page 43

Students must Know:

a. The subsystem of Aerospace Vehicles, for example:
   Propulsion — engine
   Suspension — wings and landing gear
   Structural — fuselage, ribs, and spars
   Control — ailerons, elevators, and stabilizers
b. The functions of each subsystems, for example:
   Propulsion — provides thrust
   Suspension — provides lift
   Structural — holds the craft together
   Control — changes the attitude of the craft in flight.

APPROXIMATE TIME: 180 MINUTES

PERFORMANCE OBJECTIVE: 2 — page 43

Students must Know:

a. Some of the delivery systems used for spacecraft, for example:
   - Delta Rockets
   - Saturn V
   - Space shuttle
   - Atlas

b. What spacecraft configurations have been important in the development of the U.S. space program, for example:
   - Ranger
   - Surveyor
   - Pioneer
   - Echo
   - Viking
   - Voyager

c. What applied sources of energy are utilized by spacecraft, for example:
   - Solar cells
   - Fuel cells
   - Solid fuel
   - Liquid fuel
   - Electron beam
   - Solar wind
   - Nuclear

APPROXIMATE TIME: 120 MINUTES

TOPIC: Outputs

PERFORMANCE OBJECTIVE: 1 — page 45

Students must Know:

a. What environmental and ecological impacts have been caused by Aerospace Transportation, for example:
   - Disruption of wild life
   - Exhaust pollution
   - Noise pollution
   - Waste disposal
   - Space junk

b. What Aerospace technological advancements can be associated with environmental concerns, for example:
   - The turbofan engine minimizes noise pollution
   - Stronger and lighter aircraft materials lower demand for fuel.
   - Reusable booster rockets cut down on material needs and ocean space junk.
   - New wing shapes and configurations lower fuel consumption.

APPROXIMATE TIME: 120 MINUTES

TOPIC: Monitor/Control

PERFORMANCE OBJECTIVE: 1 — page 46

Students must Know:

a. What scientific principles are used during the operation and reading of aircraft instruments, for example:
   - Altimeter works off an aneroid barometer.
   - Compass (magnetism) is a direction seeking device.
   - Artificial horizon uses a gyroscope.
   - A Cylinder head temperature gauge uses a thermocouple.

b. How important flight instruments are to the pilot, for example:
   - Altimeter, provides the planes altitude above the ground.
   - Vertical speed indicator, tells the pilot his rate of climb in feet/minutes.
   - The artificial horizon indicates if the plane is climbing, descending, banking, or flying straight and level.

APPROXIMATE TIME: 60 MINUTES

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